Noise Assessment
Borrego Photovoltaic Solar Farm
MUP 09-012 (APN 141-230-26)
MUP 09-014 (APN 141-230-33)
Log No. ER. 09-05-001

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GLOSSARY OF TERMS

Sound Pressure Level (SPL): a ratio of one sound pressure to a reference pressure (L_{ref}) of 20 µPa. Because of the dynamic range of the human ear, the ratio is calculated logarithmically by 20 log (L/L_{ref})

A-weighted Sound Pressure Level (dBA): Some frequencies of noise are more noticeable than others. To compensate for this fact, different sound frequencies are weighted more.

Minimum Sound Level (L_{min}): Minimum SPL or the lowest SPL measured over the time interval using the A-weighted network and slow time weighting.

Maximum Sound Level (L_{max}): Maximum SPL or the highest SPL measured over the time interval the A-weighted network and slow time weighting.

Equivalent sound level (L_{eq}): the true equivalent sound level measured over the run time. Leq is the A-weighted steady sound level that contains the same total acoustical energy as the actual fluctuating sound level.

Day Night Sound Level (LDN): Representing the Day/Night sound level, this measurement is a 24 –hour average sound level where 10 dB is added to all the readings that occur between 10 pm and 7 am. This is primarily used in community noise regulations where there is a 10 dB "Penalty" for night time noise. Typically LDN's are measured using A weighting.

Community Noise Exposure Level (CNEL): The accumulated exposure to sound measured in a 24-hour sampling interval and artificially boosted during certain hours. For CNEL, samples taken between 7 pm and 10 pm are boosted by 5 dB; samples taken between 10 pm and 7 am are boosted by 10 dB.

Octave Band: An octave band is defined as a frequency band whose upper band-edge frequency is twice the lower band frequency.

Third-Octave Band: A third-octave band is defined as a frequency band whose upper band-edge frequency is 1.26 times the lower band frequency.

Response Time (F,S,I): The response time is a standardized exponential time weighting of the input signal according to fast (F), slow (S) or impulse (I) time response relationships. Time response can be described with a time constant. The time constants for fast, slow and impulse responses are 1.0 seconds, 0.125 seconds and 0.35 milliseconds, respectively.

EXECUTIVE SUMMARY

This noise study has been completed to determine the noise impacts associated with the development of the proposed Project. The Project known as the Borrego Photovoltaic Solar Farm consists of two parcels totaling approximately 341 gross acres. Each parcel requires a Major Use Permit (MUP). The Project is located in the unincorporated community of Borrego Springs in eastern portion of San Diego County, CA.

Based on the empirical data, the manufactures specifications and the distances to the property lines the unshielded cumulative noise levels from the proposed transformers/inverters and the Substation were found to be below the most restrictive nighttime property line standard of 45 dBA at the S-92 and RR.25 zoning. The operational equipment was also found to comply with the less restrictive M-52 zoning standard of 70 dBA anytime. No impacts are anticipated and no mitigation is required.

The Project plans to install improvements at the existing Borrego Substation that will affect an area approximately 0.8 acres and will include installation of a new 69 kV termination rack (bus bar), associated conductors and insulators, two breakers, two disconnect switches, and associated protection and control equipment. No noise generating equipment is proposed as part of the expansion and therefore no impacts would occur.

The measured Corona Affect noise levels were found to be below the County of San Diego's most restrictive nighttime standard of 45 dBA. This was also consistent with previously measured and modeled noise levels on transmission line projects throughout California. No impacts from the Corona Affect are anticipated from the new transmission lines associated with the proposed Project.

At a distance as close as 165-feet the point source noise attenuation from construction activities and the nearest property line is -10.4 dBA. This would result in an anticipated worse-case 8-hour average combined noise level of 74.9 dBA at the property line. Given this and the spatial separation of the equipment over the large site area, the noise levels are anticipated to comply with the County of San Diego's 75 dBA standard at all Project property lines.

Additionally, the County Noise Ordinance Section 36.409 (c), states that the 75 dBA threshold pertains to a property having an occupied structure. The properties adjacent the Project site do not have occupied structure and therefore are exempt from Section 36.409. The nearest legal residential dwelling unit to the Project site is over 1,200 feet to the south and more than 1,500 feet in any other direction. At a distance of 1,200 feet, the point-source noise attenuation would be greater than 25 dBA and the grading construction related noise levels would be well below the 75 dBA standard.

1.0 INTRODUCTION

1.1 Project Description

This noise study was completed to determine the noise impacts associated with the development of the proposed Borrego Photovoltaic Solar Farm Project. The Project is located at 33° 15′ 43″ N and 116° 19′ 35″ W, north of Palm Canyon Drive and east of Borrego Valley Road in the unincorporated community of Borrego Springs in northeastern San Diego County, CA. The general location of the Project is shown on the Vicinity Map, Figure 1-A.

The proposed Project would result in the construction, operation and maintenance of a photovoltaic (PV) solar farm within the community of Borrego Springs, California in northeastern San Diego County. Eurus Energy America Corporation's wholly owned subsidiary, EE Borrego Land LLC, and its affiliates (herein referred to as Eurus Energy) proposes to develop such facilities to allow for the long-term generation of clean energy from solar power that would ultimately be sold and distributed for public consumption.

The facilities will consist of an array of fixed-tilt, non-tracking solar PV panels, inverter/switching gear housed in 38 12-foot by 26.5-foot structures, one 20-foot by 30-foot storage shed, two onsite substations, and supporting transmission facilities. Energy generated will be transferred to the existing Borrego Substation, located approximately one mile to the west of the 288-acre parcel, adjacent to Borrego Valley Road, via a series of overhead transmission lines. The transmission lines will extend from the 288-acre parcel to the Borrego Substation along one of two identified routes: 1) west from the northwesterly corner of the parcel within an existing 20-foot easement maintained by San Diego Gas and Electric (SDG&E) (overhead facilities); or, 2) south from the southwesterly corner of the parcel along an existing roadway to Palm Canyon Drive (underground), west along Palm Canyon Drive (overhead), then north along Borrego Valley Road (overhead). The site plan used for this analysis is shown on Figure 1-B.

Project-related improvements at the existing Borrego Substation will occur in the area immediately to the south of the existing fenced facilities. Project-related improvements at the Borrego Substation will affect an area approximately 0.8 acres and will include installation of a new 69 kV termination rack (bus bar), associated conductors and insulators, two breakers, two disconnect switches, and associated protection and control equipment. A "breakaway" perimeter fence 8 feet in height topped with one foot of barbed wire (similar to existing fencing around the Borrego Substation facilities) will be installed for security purposes. The proposed Borrego Substation expansion layout is provided in Figure 1-C below. It is anticipated that construction of the proposed Project will begin in the fall of 2010 with all phases of construction completed by the fall of 2011.

Figure 1-A: Project Vicinity Map

Source: Google Maps, 12/09

Figure 1-B: Project Site Plan

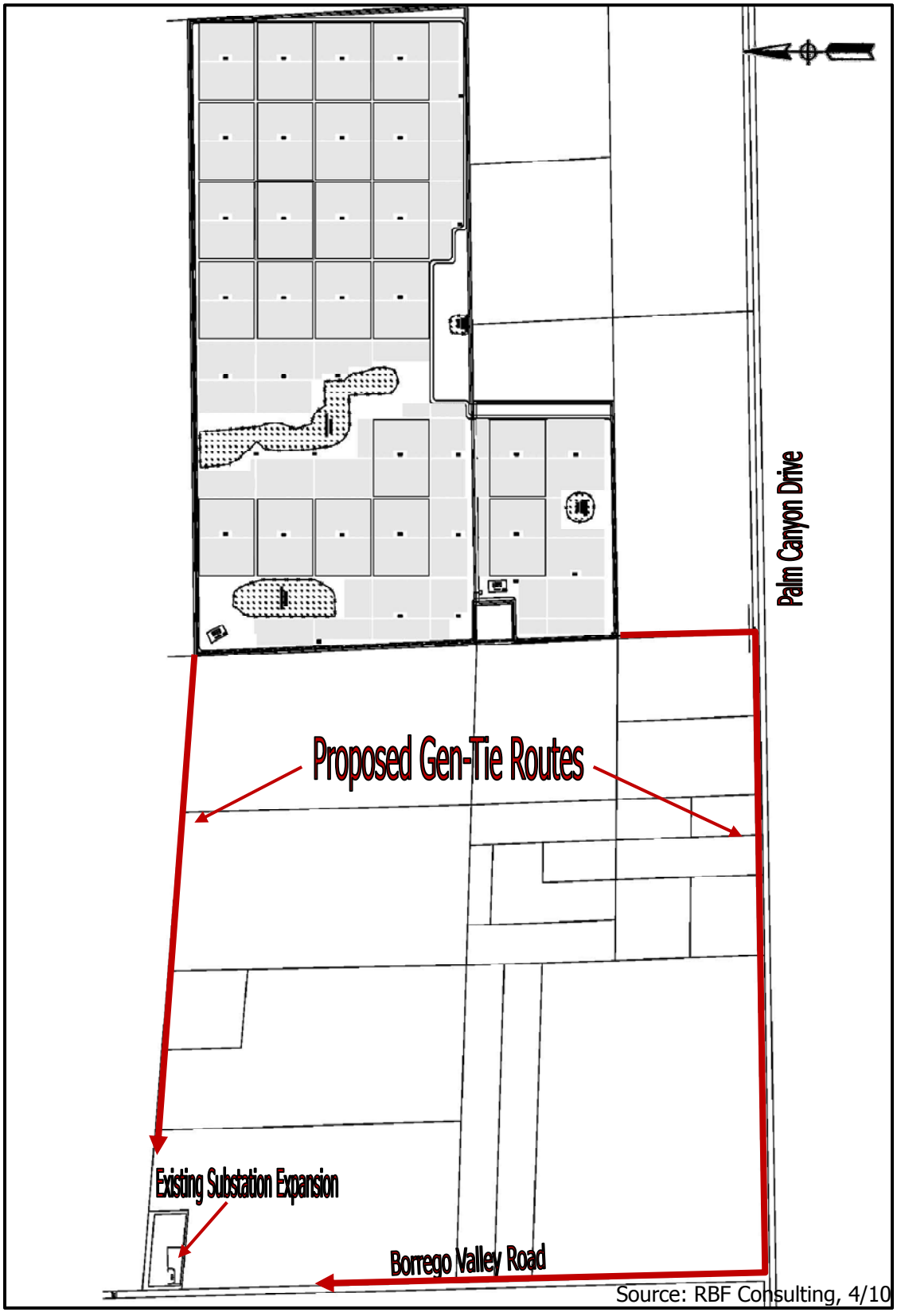
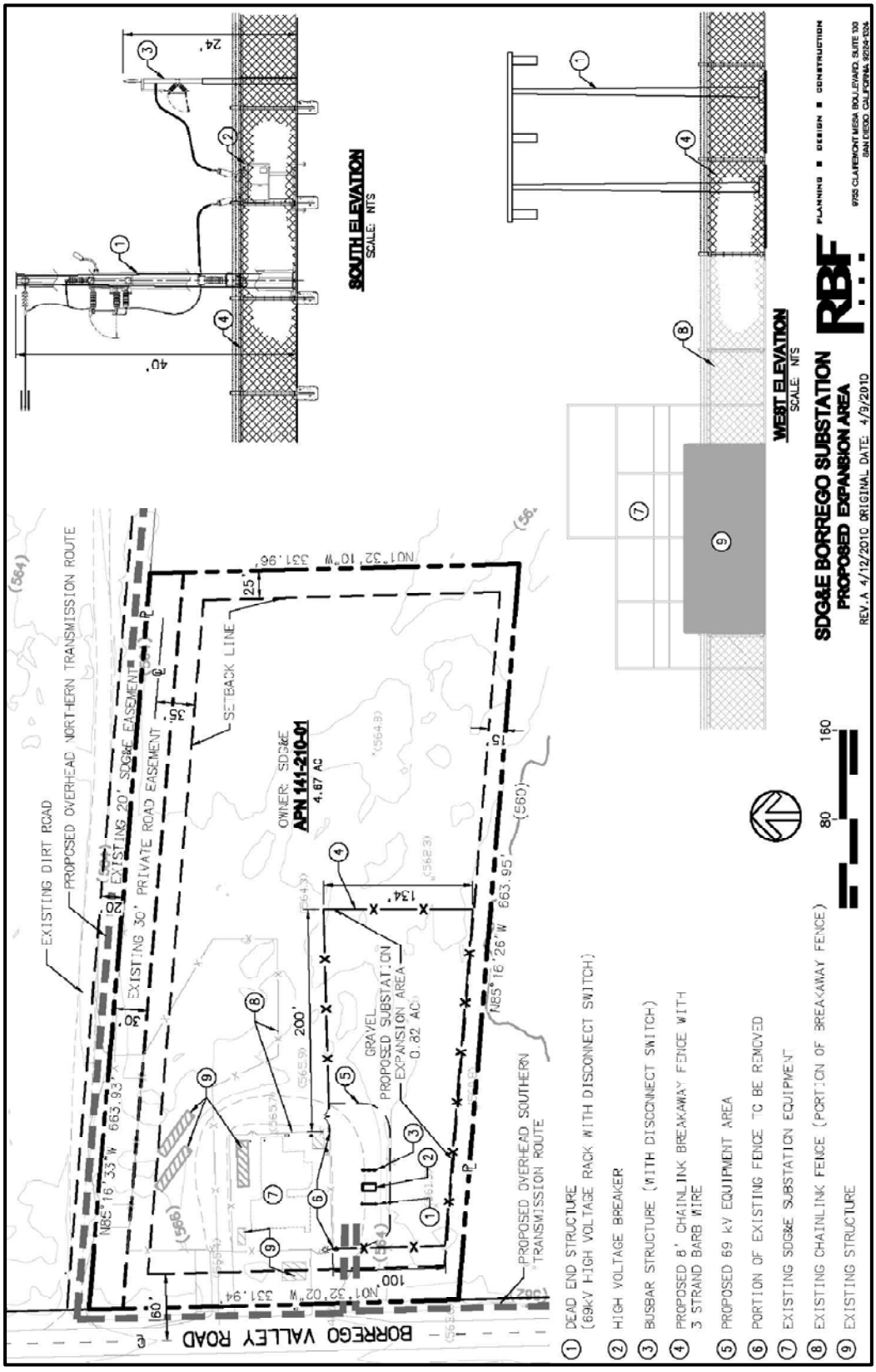


Figure 1-C: Existing Borrego Substation Expansion Plan



1.2 Environmental Settings & Existing Conditions

a) Settings & Locations

The Project would consist of two separate solar generation facilities on two individual parcels of land, with additional lands affected to allow for transport of the power generated to the existing Borrego Substation. The County Assessor Parcel Numbers (APNs) affected by the proposed Project for the main facilities include 141-230-26 (approximately 288 acres) and a portion of 141-230-33 (approximately 53 acres - to be leased by the Project proponent). Access to the 288-acre parcel and 53-acre lease parcel will be provided from Palm Canyon Drive via an existing 12- to 16-foot wide decomposed granite (d.g.) access road. The zoning for the two Project parcels is as follows: the 288-Acre Parcel is zoned General Rural (S92) and the 53-acre Parcel, Rural Residential (RR.25). Additionally, the Project lies within the influence of the Borrego Valley Airport Land Use Compatibility Plan (ALUCP).

b) Existing Noise Conditions

The Project is located adjacent to the Borrego Valley Airport and Palm Canyon Drive, described as a community collector (2.1D) roadway in the County of San Diego's Circulation Element. Existing noise occurs mainly from vehicular traffic traveling on Palm Canyon Drive and air traffic from the adjacent County airport.

1.3 Methodology and Equipment

a) Noise Measuring Methodology and Procedures

To determine the ambient noise environment and to assess potential noise impacts, measurements of the Corona Affect were taken along an existing SDGE 69 kV transmission line located south of Borrego Valley Road. This was done to determine the local conditions and to establish a baseline form the Corona Affect of the proposed transmission lines. The noise measurements were recorded on December 4, 2009 by Ldn Consulting, Inc. between approximately 9:30 a.m. and 10:00 a.m. in dry, calm and clear conditions. The sound levels for the proposed on-site equipment were taken from the manufacture's specifications.

Noise measurements were taken using a Larson-Davis Model LxT Type 1 precision sound level meter, programmed, in "slow" mode, to record noise levels in "A" weighted form. The LxT was set to record in the low range of -10 to 110 dBA. The sound level meter and microphone were mounted on a tripod, five feet above the ground and equipped with a windscreen during all measurements. The sound level meter was calibrated before and after the monitoring using a Larson-Davis calibrator, Model CAL 200.

The noise measurement location was determined based on site access and low ambient conditions to capture only the potential transmission line noise levels. The 69 kV transmission line measurements were taken mid-span between two power poles along an existing San Diego Gas & Electric (SDGE) easement south of Borrego Valley Road. The noise measurement location and relationship to the proposed Project location is provided graphically in Figure 1-D on Page 5, denoted by the SDGE Easement marker.

Figure 1-D: Corona Affect Noise Measurement Location

b) Noise Calculations and Factors

Noise is defined as unwanted or annoying sound which interferes with or disrupts normal activities. Exposure to high noise levels has been demonstrated to cause hearing loss. The individual human response to environmental noise is base on the sensitivity of that individual,

the type of noise that occurs and when the noise occurs.

Sound is measured on a logarithmic scale consisting of sound pressure levels known as a decibel (dB). The sounds heard by humans typically do not consist of a single frequency but of a broadband of frequencies having different sound pressure levels. The method for evaluating all the frequencies of the sound is to apply an A-weighting to reflect how the human ear responds to the different sound levels at different frequencies. The A-weighted sound level adequately describes the instantaneous noise whereas the equivalent sound level depicted as Leq represents a steady sound level containing the same total acoustical energy as the actual fluctuating sound level over a given time interval.

The Community Noise Equivalent Level (CNEL) is the 24 hour A-weighted average for sound, with corrections for evening and nighttime hours. The corrections require an addition of 5 decibels to sound levels in the evening hours between 7 p.m. and 10 p.m. and an addition of 10 decibels to sound levels at nighttime hours between 10 p.m. and 7 a.m. These additions are made to account for the increased sensitivity during the evening and nighttime hours when sound appears louder.

Because mobile/traffic noise levels are calculated on a logarithmic scale, a doubling of the traffic noise or acoustical energy results in a noise level increase of 3 dBA. Therefore the doubling of the traffic volume, without changing the vehicle speeds or mix ratio, results in a noise increase of 3 dBA. Mobile noise levels radiant in an almost oblique fashion from the source and drop off at a rate of 3 dBA for each doubling of distance under hard site conditions and at a rate of 4.5 dBA for soft site conditions. Hard site conditions consist of concrete, asphalt and hard pack dirt while soft site conditions exist in areas having slight grade changes, landscaped areas and vegetation. On the other hand, fixed/point sources radiate outward uniformly as it travels away from the source. Their sound levels attenuate or drop off at a rate of 6 dBA for each doubling of distance.

The most effective noise reduction methods consist of controlling the noise at the source, blocking the noise transmission with barriers or relocating the receiver. Any or all of these methods may be required to reduce noise levels to an acceptable level.

2.0 OPERATIONAL ACTIVITIES

2.1 Guidelines for the Determination of Significance

Section 36.404 of the County of San Diego noise ordinance provides performance standards and noise control guidelines for determining and mitigating non-transportation, or stationary, noise source impacts to adjacent properties. The purpose of the noise ordinance is to protect, create and maintain an environment free from noise that may jeopardize the health or welfare, or degrade the quality of life.

The County Noise Ordinance states that it shall be unlawful for any person to cause or allow the creation of any noise to the extent that the one-hour average sound level, at any point on or beyond the boundaries of the property exceeds the applicable limits provided in Table 2-1.

Table 2-1: Sound Level Limits in Decibels (dBA)

ZONE		APPLICABLE LIMIT ONE-HOUR AVERAGE SOUND LEVEL (DECIBELS)
R-S, R-D, R-R, R-MH, A-70, A-72, S-80, S-81, S-87, S-88, S-90, S-92, R-V, and R-U Use Regulations with a density of less than 11 dwelling units per acre.	7 a.m. to 10 p.m. 10 p.m. to 7 a.m.	50 45
R-RO, R-C, R-M, C-30, S-86, R-V, R-U and V5. Use Regulations with a density of 11 or more dwelling units per acre.	7 a.m. to 10 p.m. 10 p.m. to 7 a.m.	55 50
S-94, V4, and all other commercial zones.	7 a.m. to 10 p.m. 10 p.m. to 7 a.m.	60 55
V1, V2 V1, V2 V1 V2	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m. 10 p.m. to 7 a.m.	60 55 55 50
V3	7 a.m. to 10 p.m. 10 p.m. to 7 a.m.	70 65
M-50, M-52, M-54	Anytime	70
S-82, M-58, and all other industrial zones.	Anytime	75

Source: County of San Diego Noise Ordinance Section 36.404

As stated above in Section 1, the Project and surrounding properties are zoned General Rural (S92), Rural Residential (RR.25) and Limited Industrial (M52). Section 36.404 of the Noise Ordinance sets a most restrictive operational exterior noise limit for the S92 and residential noise sensitive land uses of 50 dBA Leq for daytime hours of 7 a.m. to 10 p.m. and 45 dBA Leq

during the noise sensitive nighttime hours of 10 p.m. to 7 a.m. as shown in Table 2-1 above. Most of the Project components will only operate during the daytime hours but a few may operate during nighttime hours and therefore the most restrictive and conservative approach is to apply the 45 dBA Leq nighttime standard at the property lines zoned S92 and RR.25. A standard of 70 dBA anytime will be applied at the property lines zoned M-52.

2.2 Potential Operational Noise Impacts

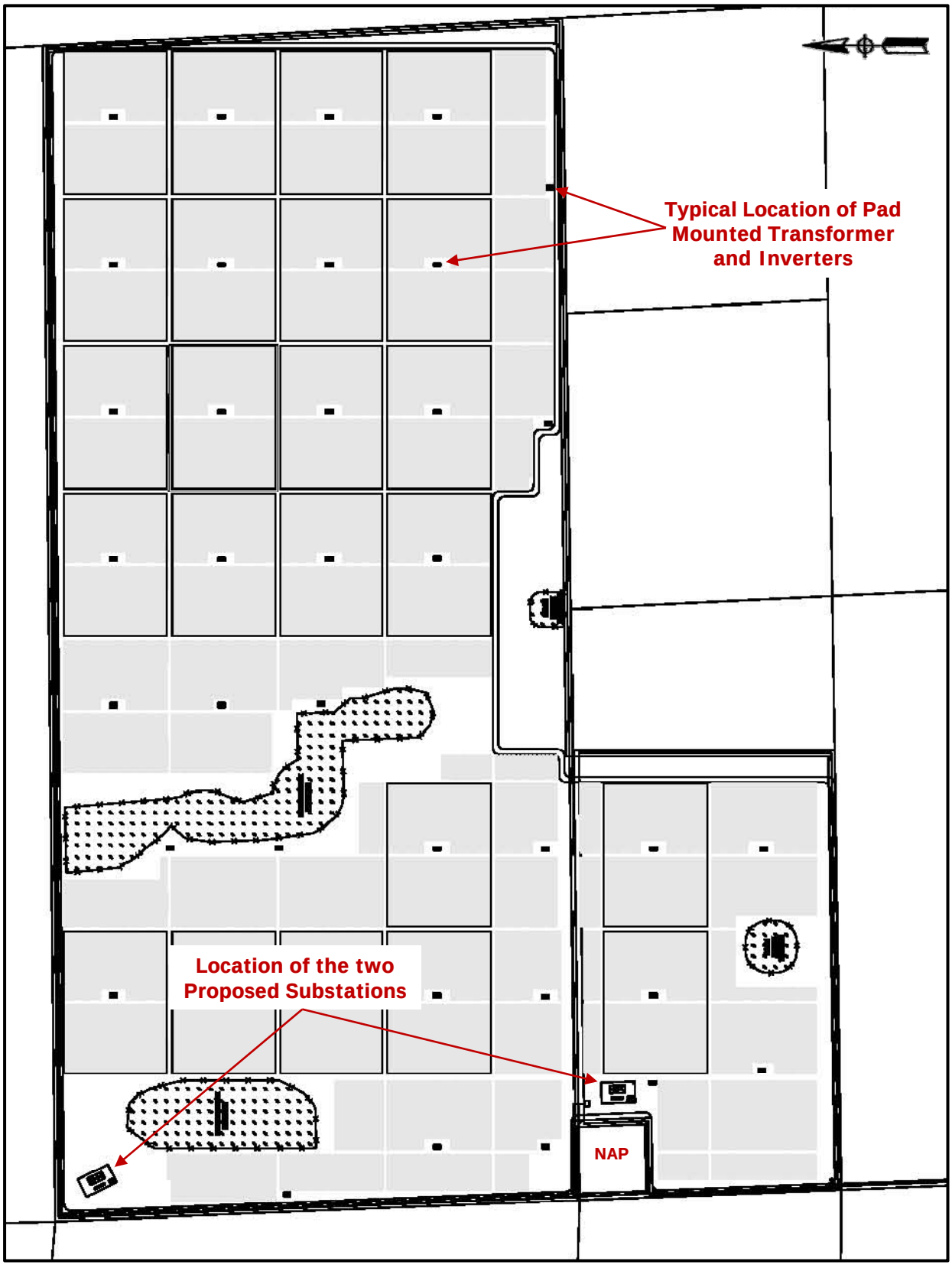
This section examines the potential stationary noise source impacts associated with the operation of the proposed Borrego Photovoltaic solar Farm. Specifically, noise levels from the proposed transformers, inverters, the substations and the transmission lines.

Panels would be electrically connected into panel strings using wiring attached to the racking. Panel strings would be electrically connected to each other via underground wiring. Wire depths would be in accordance with local, State, and Federal codes. Gathering lines would connect individual panel strings to one or more inverters/transformers and combiner boxes distributed throughout the facility. Wiring from the panel strings are connected to combiner boxes. The electrical current is then transferred to the inverters, which convert the Direct Current (DC) produced by the PV panels into Alternating Current (AC). A pad-mounted transformer next to the inverter would increase the voltage. The AC would then travel through underground gathering lines to the 2 Project Substations.

The Project proposes the installation of 38 small-scale, above ground structures that would be located within the solar panel fields to weatherize inverter/distributor transformers and switching gear. These structures would be approximately 10 by 26 feet in size and 12 feet high at the roof apex. They would be constructed of concrete or steel and would be beige or neutral in color. The buildings will house each proposed Satcon PowerGate Plus 1 MW Commercial Solar PV Inverters, or equivalent, and one of the smaller necessary transformers to increase the voltage. The transformer and inverter buildings will be spread out over the site with one transformer and one inverter grouped next to each other. The Project also proposes two private Substations located on the western portion of the site. The proposed 38 small-scaled buildings and 2 Substation locations can be seen in Figure 2-A on the following page and for more details MUP Plot Plan Sheet 2 of 3.

The Project plans to install improvements at the existing Borrego Substation that will affect an area approximately 0.8 acres and will include installation of a new 69 kV termination rack (bus bar), associated conductors and insulators, two breakers, two disconnect switches, and associated protection and control equipment. No noise generating equipment is proposed as part of the expansion and therefore no impacts would occur and no further analysis is warranted. A photo of the proposed "bus bar" is provided as Attachment A of this report.

Figure 2-A: Proposed Equipment Locations



The electric power produced by the Project will be feed into the existing system with the incorporation of a new 12 kV and a new 69 kV Gen-Tie transmission lines running from the site to the existing transmission lines located along Borrego Valley Road to the west. Two alternative routes have been identified. The northern route runs from the northern portion of the site to the existing SDGE Substation along Borrego Valley Road. The southern route would run along Palm Canyon Drive and then tie into the exiting transmission lines. The new transmission lines may increase a phenomenon referred to as the "Corona Affect" along the new transmission route. The operational noise levels from the proposed on site small-scale inverter/transformer buildings along with the two Substations' equipment and the offsite Corona Affect are analyzed separately below.

2.2.1 Operational Noise Levels On-site

The Project is proposing two different small-scaled transformers as part of the 38 proposed buildings. The two smaller transformers consist of a 1 MVA from 200V to 12 kV and a 1 MVA from 12V to 34.5 kV. A larger transformer is proposed as part of the Project private substation and a 20 MVA from 34.5 to 69 kV. The unshielded noise levels for these two small-scaled transformers and the larger transformer are provided below, respectively *(Source: National Electric Manufactures Association (NEMA) Publication No. TR 1-1993)*:

1. 1 MVA from 200V to 12 kV - guaranteed 58 dBA @ 5-feet
2. 1 MVA from 12V to 34.5 kV - guaranteed 58 dBA @ 5-feet
3. 20 MVA from 34.5 to 69 kV - guaranteed 71 dBA @ 5-feet

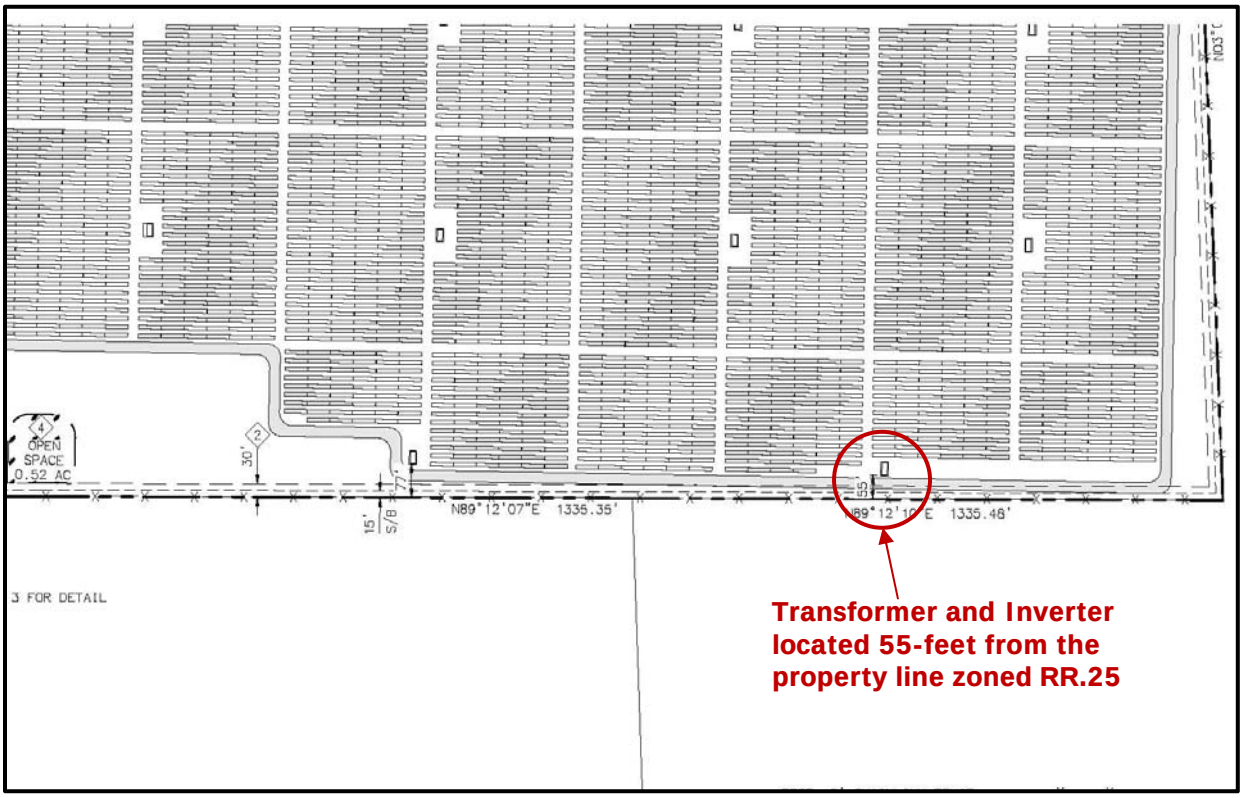
As mention above, each small-scale building will also have an inverter along with a small transformer. The proposed Satcon PowerGate Plus 1 MW Commercial Solar PV Inverter, or equivalent, has an unshielded noise rating of less than 65 dBA at 5-feet *(Source: Satcon PowerGate Specifications, 2009)*. The NEMA test results for transformers and the proposed Satcon inverters manufacturer's specifications are provided as Attachment B of this report.

Based upon the Project site layout and the adjacent property zoning two potential impacts may occur. The first potential impact is located along the southern property line where one of the transformer/inverter buildings in located 55-feet from the property line. The second potential impact is located along the western property line where the private Substation and a single transformer/inverter building may combine to create a cumulative impact. All other proposed pieces of equipment on the site are either farther from the property line and/or adjacent to M-52 zoned property having a sound level limit of 70 dBA and no impacts are anticipated. The two worst-case scenarios were analyzed separately below to determine if impacts would occur and if additional analysis of more pieces of equipment is warranted and if any mitigation measures will be required.

Southern Property Line

The worst-case southern property line noise levels will occur near the center of that property line where a transformer/inverter building is located 55-feet from the property to the south which is zoned RR.25 and has a nighttime property line standard of 45 dBA. The location and relationship to the southern property line is shown in Figure 2-B below. The two noise levels of 58 dBA for the transformer and 65 dBA for the inverter were combined and propagated out to the southern property line without any shielding from the proposed buildings. The results of the propagated noise levels are shown in Table 2-2.

Figure 2-B: Worst-Case Southern Property Line Noise Levels



The combined noise level at the nearest property line was projected to be 45.0 dBA Leq and no impacts are anticipated. Therefore at a distance of 55-feet or more the transformers/inverters, unshielded, will comply with the most restrictive property line standards and no future analysis is needed for the transform/inverters. The transformers/inverters will be housed inside a concrete and steel building which will further reduce the noise levels. Additionally, the transformers/inverters are located approximately 400-feet or more from each other and will not cumulatively raise the noise levels at the nearest property line due to distance.

Table 2-2: Operational Noise Levels – Southern Property Line

Source	Noise Level @ 5-Feet (dBA)[1]	Distance to Nearest Property Line (Feet)	Noise Reduction due to distance (dBA)	Resultant Noise Level @ Property Line (dBA)
Transformer	58.0	55	-20.8	37.2
Inverter	65.0	55	-20.8	44.2
Cumulative Noise Level @ Property Line (dBA)				45.0

[1] Noise data provided as an attachment to this report

Western Property Line

The worst-case western property line noise levels will occur near the center of the Project where the southern Substation is proposed more than 105-feet from the property line zoned RR.25, currently used as a cell tower site, and a single small-scaled transformer/inverter building is located 180-feet from the same property line to the west. A small-scaled transformer/inverter building is located north of the property line, zoned RR.25, at a distance of 135-feet away. As stated above; at a distance of 55-feet or more the transformers/inverters, unshielded, will comply with the most restrictive property line standards and no impacts are anticipated. The location and relationships of the Substations and the western property line are shown in Figure 2-C on Page 13. The northern Substation location is farther from the western and northern property lines and would require the same mitigation, if any, as would the southern Substation.

The noise levels of 58 dBA from the transformer, 65 dBA from the inverter and 71 dBA for the large transformer at the Substation were combined and propagated out to the western property line without any shielding from the proposed buildings. The results of the propagated noise levels are shown in Table 2-3.

The combined noise level at the nearest property line was projected to be 45.0 dBA Leq and no impacts are anticipated from the Substations located at the southern and northern locations. Therefore at a distance of 105-feet or more from the Substations in combination with the pad mounted transformer/inverter at 180-feet will comply with the most restrictive property line standards without shielding and no future analysis is needed. The transformers/inverters will be housed inside a concrete or steel building which will further reduce the noise levels. Additionally, all remaining small-scale transformers/inverters are located approximately 400-feet or more from the Substation and will not cumulatively raise the noise levels at the nearest property line due to distance.

Figure 2-C: Worst-Case Western Property Line Noise Levels

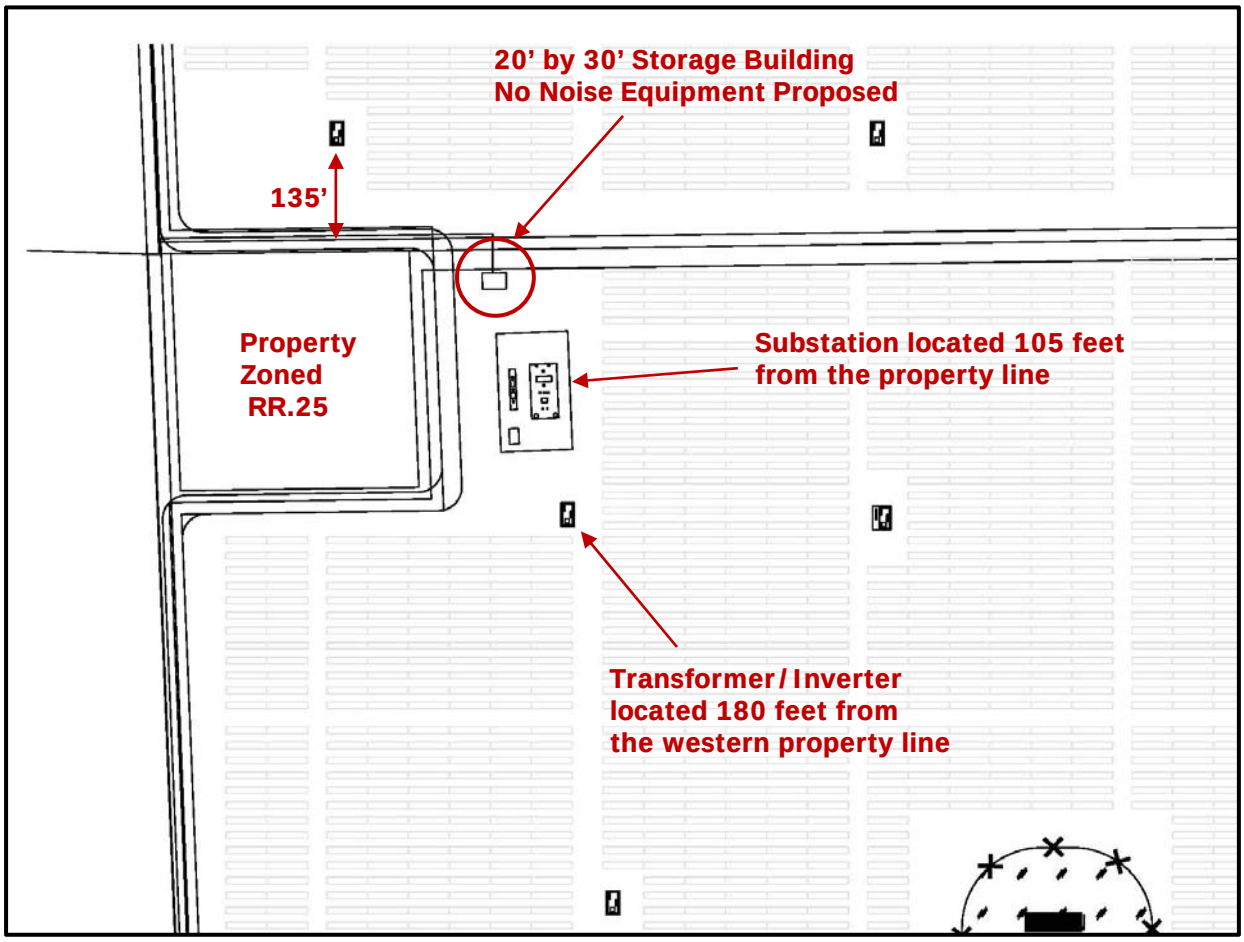


Table 2-3: Operational Noise Levels – Western Property Line

Source	Noise Level @ 5-Feet (dBA)[1]	Distance to Nearest Property Line (Feet)	Noise Reduction due to distance (dBA)	Resultant Noise Level @ Property Line (dBA)
Transformer	58.0	180	-31.1	26.9
Inverter	65.0	180	-31.1	33.9
Substation	71.0	105	-26.4	44.6
Cumulative Noise Level @ Property Line (dBA)				45.0

[1] Noise data provided as an attachment to this report

2.2.2 Corona Affect Noise Levels

The Corona Affect (Corona) is a phenomenon associated with the electrical ionization of the air that occurs near the surface of the energized conductor and suspension hardware due to very high electric field strength. This is audible power line noise that is generated from electric corona discharge, which is usually experienced as a random crackling or hissing sound. The amount of corona produced by a transmission line is a function of the voltage of the line, the diameter of the conductors, the locations of the conductors in relation to each other, the elevation of the line above sea level, the condition of the conductors and hardware, and the local weather conditions.

Corona increases at higher elevations where the density of the atmosphere is less than at sea level. Audible noise will vary with elevation with the relationship of X/300 where X is the elevation of the transmission line above sea level measured in meters (EPRI 2005). Audible noise at 600 meters (~2,000 feet) in elevation will be twice the audible noise at 300 meters, all other things being equal. Typically for transmission lines of 138 kV and less, the maximum corona noise during wet weather conditions is usually less than 40 dBA at the edge of the ROW *(Source: Miguel-Mission 230 kV #2 Project, Aspen Environmental Group, 2004).* Corona typically becomes a design concern for transmission lines at 345 kV and above and is less noticeable from lines like those proposed for the Project that are operated at lower voltages.

The electric field gradient is greatest at the surface of the conductor. Large-diameter conductors have lower electric field gradients at the conductor surface and, hence, lower corona than smaller conductors. The conductors chosen for the Gen-Tie Lines were selected to have larger diameters and thus a reduced potential to create audible noise. Irregularities, such as nicks and scrapes on the conductor surface, concentrate the electric field at these locations and increase the electric field gradient and thus the resulting corona. Similarly, dust or insects on the conductor surface can cause irregularities and are a source for corona along with moister from fog or raindrops. Corona noise is primarily audible during wet weather conditions such as fog and rain. Heavy rain will typically generate a noise level from the falling rain drops hitting the ground that will be greater than the noise generated by corona and thus mask the audible noise from the transmission line.

Corona produced by a transmission line can be reduced by changing the design of the transmission line and through the selection of the conductors and hardware used for the construction of the line. For instance the use of conductor hangers that have rounded rather than sharp edges and no protruding sharp edges will help reduce corona.

To determine the corona of the proposed Gen-Tie transmissions lines noise measurements were taken along the existing 69 kV transmission lines in the Borrego Springs area. The short-term

measurements were conducted by Ldn Consulting December 4, 2009. The noise measurements were conducted along an existing SDGE easement south of Borrego Valley Road as depicted previously in Figure 1-C on Page 5. Due to ambient noise sources consisting of airplanes, automobiles and birds only one-minute measurements could be taken without the results being affected by factors other than the existing 69 kV transmission lines. During the noise measurements, the crackling or hissing of the transmission lines was slightly audible and the weather conditions were dry and calm. The results of those short-term measurements are provided in Table 2-4 below.

Table 2-4: Measured Corona Noise Levels along 69 kV Lines

Location	Time	One Hour Noise Levels (dBA)					
		Leq	Lmin	Lmax	L10	L50	L90
69 kV Transmission Lines – Borrego Springs	9:35–9:36 a.m.	17.6	16.7	22.7	18.7	17.0	16.8
69 kV Transmission Lines – Borrego Springs	9:37–9:38 a.m.	18.3	17.4	27.2	19.3	18.1	17.7
Source: Ldn Consulting, Inc. December 4, 2009							

As can be seen in Table 2-4, during the dry conditions the noise levels from the Corona were very low, below 20 dBA. Typically during moist or wet conditions the Corona noise can double. This would result in a noise level of 35-37 dBA which is consistent with previous studies and modeling efforts conducted by the Electric Power Research Institute (EPRI) and CH2M Hill for the Cross Valley Transmission Line Project conducted for Southern California Edison 2008.

2.3 Conclusions

Based on the empirical data, the manufactures specifications and the distances to the property lines the unshielded cumulative noise levels from the proposed transformers/inverters and the Substation were found to be below the most restrictive nighttime property line standard of 45 dBA at the S-92 and RR.25 zoning. The operational equipment was also found to comply with the M-52 zoning standards. No impacts are anticipated and no mitigation is required.

The measured Corona Affect noise levels were found to be below the County of San Diego's most restrictive nighttime standard of 45 dBA. This was also consistent with previously measured and modeled noise levels on transmission line projects throughout California. No impacts from the Corona Affect are anticipated from the new transmission lines associated with the Project.

3.0 CONSTRUCTION ACTIVITIES

3.1 Guidelines for the Determination of Significance

Construction Noise: Noise generated by construction activities related to the Project will be considered a significant impact if the noise levels exceed the standards listed in San Diego County Code Section 36.410, Construction Equipment.

Section 36.410 states:

Except for emergency work,

a) It shall be unlawful for any person to operate construction equipment between the hours of 7 p.m. of any day and 7 a.m. of the following day.

b) It shall also be unlawful for any person to operate construction equipment on Sundays, and days appointed by the President, Governor, or the Board of Supervisors for a public fast, Thanksgiving, or holiday, but a person may operate construction equipment on the above-specified days between the hours of 10 a.m. and 5 p.m. at his residence or for the purpose of constructing a residence for himself, provided that the average sound level does not exceed 75 decibels during the period of operation and that the operation of construction equipment is not carried out for profit or livelihood.

c) It shall also be unlawful to operate any construction equipment so as to cause at or beyond the property line of any property upon which a legal dwelling unit is located an average sound level greater than 75 decibels between the hours of 7 a.m. and 7 p.m.

For temporary activities, the County considers the 75 decibel (A) average to be based on a period of eight hours.

3.2 Potential Construction Noise Impacts

Construction noise represents a short-term impact on the ambient noise levels. Noise generated by construction equipment includes haul trucks, water trucks, graders, dozers, loaders and scrapers can reach relatively high levels. Grading activities typically represent one of the highest potential sources for noise impacts. The most effective method of controlling construction noise is through local control of construction hours and by limiting the hours of construction to normal weekday working hours.

The U.S. Environmental Protection Agency (U.S. EPA) has compiled data regarding the noise generating characteristics of specific types of construction equipment. Noise levels generated by

heavy construction equipment at a distance of 50 feet can range from 60 dBA for a small tractor up to 100 dBA for rock breakers. However, these noise levels diminish rapidly with distance from the construction site at a rate of approximately 6 dBA per doubling of distance. For example, a noise level of 87 dBA measured at 50 feet from the noise source would be reduced to 81 dBA at 100 feet from the source and be further reduced to 75 dBA at 200 feet from the source.

Using a point-source noise prediction model, calculations of the expected construction noise impacts were completed. The essential model input data for these performance equations include the source levels of each type of equipment, relative source to receiver horizontal and vertical separations, the amount of time the equipment is operating in a given day, also referred to as the duty-cycle and any transmission loss from topography or barriers. To determine the worst-case noise levels for the grading operations no topographic attenuation, duty-cycle reductions or barrier reductions were utilized.

According to the project applicant, the project site will be graded in one phase. The grading operation will utilize a total of up to three dozers, five graders, four loaders/backhoes and four water trucks during the mass grading activities. The noise levels utilized in this analysis based upon the anticipated list of equipment are shown in Table 3-1.

Table 3-1: Construction Noise Levels

Construction Equipment	Quantity	Duty Cycle (Hours/Day)	Source Level @ 50-Feet (dBA)	Cumulative Noise Level @ 50-Feet (dBA Leq-8h)
Grader	5	8	74	81.0
Water Truck	4	8	70	76.0
Dozer	3	8	75	79.8
Loader	4	8	73	79.0
			Cumulative Levels @ 50 Feet (dBA)	85.3
			Distance To Property Line	165
			Noise Reduction Due To Distance	-10.4
			NEAREST PROPERTY LINE NOISE LEVEL	74.9

Most of the construction activities will consist of clearing and grubbing the site for the preparation of the PV panels. Based upon normal grading operations the equipment is anticipated to be spread out over the entire site; some equipment may be operating at or near the property line while the rest of the equipment may be located over 1,000-feet from the same property line. This would result in an acoustical center for the grading operation at approximately 500-feet to

the nearest property line. As can be seen in Table 3-1, if all the equipment was operating in the same location, which is not physically possible, at a distance as close as 165-feet from the nearest property line the point source noise attenuation from construction activities is -10.4 dBA. This would result in an anticipated worse-case 8-hour average combined noise level of 74.9 dBA at the property line. Given this and the spatial separation of the equipment, the noise levels will comply with the County of San Diego's 75 dBA standard at all Project property lines.

Additionally, the County Noise Ordinance Section 36.409 (c), states that the 75 dBA threshold pertains to a property having an occupied structure. "Except for emergency work, it shall be unlawful for any person to operate construction equipment or cause construction equipment to be operated, that exceeds an average sound level of 75 decibels for an eight-hour period, between 7 a.m. and 7 p.m., when measured at the boundary line of the property where the noise source is located or on any occupied property where the noise is being received."

Some of the properties adjacent the Project site do not have a legal dwelling unit are therefore are exempt from Section 36.409. The nearest occupied residential dwelling unit to the Project site is over 1,200 feet to the south and more than 1,500 feet in any other direction. At a distance of 1,200 feet, the point-source noise attenuation would be greater than 25 dBA and the grading construction related noise levels would be well below the 75 dBA standard.

3.2 Construction Conclusions

At a distance as close as 165-feet the point source noise attenuation from construction activities and the nearest property line is -10.4 dBA. This would result in an anticipated worse-case 8-hour average combined noise level of 74.8 dBA at the property line. Given this and the spatial separation of the equipment over the large site area, the noise levels are anticipated to comply with the County of San Diego's 75 dBA standard at all Project property lines.

Additionally, the County Noise Ordinance Section 36.409 (c), states that the 75 dBA threshold pertains to a property having a legal dwelling unit. Some of the properties adjacent the Project site do not have a legal dwelling unit are therefore are exempt from Section 36.409. The nearest legal residential dwelling unit to the Project site is over 1,200 feet to the south and more than 1,500 feet in any other direction. At a distance of 1,200 feet, the point-source noise attenuation would be greater than 25 dBA and the grading construction related noise levels would be well below the 75 dBA standard. Therefore no impacts are anticipated from the grading operations at any property line or existing dwelling unit and no mitigation or additional analysis in warranted.

4.0 SUMMARY OF PROJECT IMPACTS, MITIGATION & CONCLUSIONS

- Operational Noise Analysis

  Based on the empirical data, the manufactures specifications and the distances to the property lines the unshielded cumulative noise levels from the proposed transformers/inverters and the Substation were found to be below the most restrictive nighttime property line standard of 45 dBA at the S-92 and RR.25 zoning. The operational equipment was also found to comply with the M-52 zoning standards. No impacts are anticipated and no mitigation is required.

  The measured Corona Affect noise levels were found to be below the County of San Diego's most restrictive nighttime standard of 45 dBA. This was also consistent with previously measured and modeled noise levels on transmission line projects throughout California. No impacts from the Corona Affect are anticipated from the new transmission lines associated with the proposed Project and no mitigation is required.

  The Project's planned improvements at the Borrego Substation will include installation of a new 69 kV termination rack (bus bar), associated conductors and insulators, two breakers, two disconnect switches, and associated protection and control equipment. No noise generating equipment is proposed as part of the expansion and therefore no impacts would occur.

- Construction Noise Analysis

  At a distance as close as 165-feet the point source noise attenuation from construction activities and the nearest property line is -110.4 dBA. This would result in an anticipated worse-case 8-hour average combined noise level of 74.9 dBA at the property line. Given this and the spatial separation of the equipment over the large site area, the noise levels are anticipated to comply with the County of San Diego's 75 dBA standard at all Project property lines.

  Additionally, the County Noise Ordinance Section 36.409 (c), states that the 75 dBA threshold pertains to a property having an occupied structure. "Except for emergency work, it shall be unlawful for any person to operate construction equipment or cause construction equipment to be operated, that exceeds an average sound level of 75 decibels for an eight-hour period, between 7 a.m. and 7 p.m., when measured at the boundary line of the property where the noise source is located or on any occupied property where the noise is being received."

  Some of the properties adjacent the Project site do not have a legal dwelling unit are therefore are exempt from Section 36.409. The nearest legal residential dwelling unit to the Project site is over 1,200 feet to the south and more than 1,500 feet in any other direction. At a distance of 1,200 feet, the point-source noise attenuation would be greater than 25 dBA and the grading construction related noise levels would be well below the 75 dBA standard.

5.0 CERTIFICATIONS

The contents of this report represent an accurate depiction of the existing and future acoustical environment and impacts within the proposed Borrego Photovoltaic Solar Farm development. The report was prepared by Jeremy Louden; a County approved CEQA Consultant for Acoustics.

Jeremy Louden
Principal
Ldn Consulting, Inc.

Date June 10, 2010

ATTACHMENT A

PROPOSED 69 KV TERMINATION RACK
(Borrego Substation Expansion)

ATTACHMENT B

MANUFACTURES SPECIFICATIONS AND NOISE DATA
(Transformers and Inverters)

NEMA Standards Publication No. TR 1-1993 (R2000)

Transformers, Regulators and Reactors

Published by:

National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847
Rosslyn, VA 22209

TABLE OF CONTENTS

FOREWORD

The standards appearing in this publication have been developed by the Transformer Section and have been approved for publication by the National Electrical Manufacturers Association. They are used by the electrical industry to promote production economies and to assist users in the proper selection of transformers.

The Transformer Section is working actively with the American National Standards Committee, C57, on Transformers, Regulators and Reactors, in the development, correlation and maintenance of national standards for transformers. This Committee operates under the procedures of the American National Standards Institute (ANSI).

It is the policy of the NEMA Transformer Section to remove material from the NEMA Standards Publication as it is adopted and published in the American National Standard C57 series. The NEMA Standards Publication for Transformers, Regulators and Reactors references these and other American National Standards applying to transformers, and is intended to supplement, without duplication, the American National Standards.

The NEMA Standards Publication for Transformers, Regulators and Reactors contains provision for the following:

a. American National Standards adopted by reference and applicable exceptions approved by NEMA, if any.
b. NEMA Official Standards Proposals. These are official drafts of proposed standards developed within NEMA or in cooperation with other interested organizations, for consideration by ANSI. They have a maximum life of five years, during which time they may be approved as American National Standards or adopted as NEMA Standards, or rescinded.
c. Manufacturing Standards. These are NEMA Standards which are primarily of interest to the manufacturers of transformers and which are not yet included in an American National Standard.
d. Standards Which Are Controversial. These are NEMA Standards, on which there is a difference of opinion within Committee C57. The NEMA version will be included in the NEMA Standards Publication until such time as the differences between ANSI and NEMA are resolved.

NEMA Standards Publications are subject to periodic review and take into consideration user input. They are being revised constantly to meet changing economic conditions and technical progress. Users should secure latest editions. Proposed or recommended revisions should be submitted to:

Vice President, Engineering Department
National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, D.C. 20037-1526

SCOPE

This publication provides a list of all ANSI C57 Standards that have been approved by NEMA. In addition it includes certain NEMA Standard test methods, test codes, properties, etc., of liquid-immersed transformers, regulators, and reactors that are not American National Standards.

PART 0
GENERAL

The following American National Standards have been approved as NEMA Standards and should be inserted in this Part 0:

ANSI/IEEE C57.12.00-1988	*General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers*
ANSI/IEEE C57.12.01-1989	*General Requirements for Dry Type Power and Distribution Transformers*
ANSI C57.12.10-1988	*Requirements for Transformers 230,000 volts and below, 833/958-8333/10,417 kVA single-phase 750/862-60,000/80,000/100,000 kVA three phase, including supplements*
ANSI C57.12.70-1993	*Terminal Markings and Connections for Distribution and Power Transformers*
ANSI/IEEE C57.12.90-1993	*Test Code for Liquid-immersed Distribution, Power & Regulating Transformers and Guide for Short-Circuit Testing of Distribution & Power Transformers*
ANSI/IEEE C57.19.00-1992	*General Requirements and Test Procedure for Outdoor Apparatus Bushings*
ANSI/IEEE C57.19.01-1992	*Standard Performance Characteristics & Dimensions for Outdoor Apparatus Bushings*
ANSI/IEEE C57.92-1992	*Guide for Loading Mineral-oil-immersed Power Transformers up to and including 100 MVA with 55C or 65C Average Winding Rise*

The NEMA Standards TR 1-0.01 through TR 1-0.09 on the following pages (see Part 0 Pages 1–9) also apply generally to transformers.

0.01 PREFERRED VOLTAGE RATINGS

Preferred system voltages and corresponding transformer voltage ratings are given in the American National Standard for Electric Power Systems and Equipment--Voltage Ratings (60 Hz), C84.1-1989. It is recommended that these ratings be used as a guide in the purchase and operation of transformers.

0.02 FORCED-AIR (FA) AND FORCED-OIL (FOA) RATINGS

Under the conditions of par. 5.11 of American National Standard ANSI/IEEE C57.12.00-1988, the relationship between self-cooled ratings and forced-air-cooled or forced-oil-cooled ratings shall be in accordance with Table 0-1.

Table 0-1
FORCED-AIR AND FORCED-OIL RATINGS RELATIONSHIPS

	Self-cooled Ratings* (kVA)		Percent of Self-Cooled Ratings With Auxiliary Cooling	
Class	Single Phase	Three Phase	First Stage	Second Stage
OA/FA	501-2499	501-2499	115	--
OA/FA	2500-9999	2500-11999	125	--
OA/FA	10000 and above	12000 and above	133-1/3	--
OA/FA/FA	10000 and above	12000 and above	133-1/3	166-2/3
OA/FA/FOA	10000 and above	12000 and above	133-1/3	166-2/3
OA/FOA/FOA	10000 and above	12000 and above	133-1/3	166-2/3

*In the case of multi-winding transformers or autotransformers, the ratings given are the equivalent two-winding ratings.

PERFORMANCE

0.03 RADIO INFLUENCE VOLTAGE LEVELS

The following values apply to liquid-filled transformers. They do not apply to load tap changing during switching or to operation of auxiliary relays and control switches.

0.03.1 Distribution Transformers

Radio influence voltage levels for distribution transformers, for systems rated 69 kV and less, shall not exceed 100 microvolts when measured in accordance with Section 7.01. The test voltage shall be the line-to-neutral voltage corresponding to 110 percent excitation of the transformer. This will be the coil voltage for wye connections and 1/3 times the coil voltage for delta connections.

0.04 POWER FACTOR OF INSULATION OF OIL-IMMERSED TRANSFORMERS

While the real significance which can be attached to the power factor of oil-immersed transformers is still a matter of opinion, experience has shown that power factor is helpful in assessing the probable conditions of the insulation when good judgement is used.

The proper interpretation of power factor of oil-immersed transformers is being given careful attention by manufacturers in connection with the problems of (1) selecting insulating materials, (2) sealing, and (3) processing the transformers. However, it is the comparative values which are guides for the successful solution for these problems rather than an absolute value of power factor.

The generally accepted factory tests for proving the insulation level are the prescribed low-frequency tests and impulse tests given in the American National Standard C57.12.90-1993.

When required, a factory power-factor test can be made, and this measurement will be of value for comparison with field power-factor measurements to assess the probable condition of the insulation. It is not feasible to establish standard power-factor values for oil-immersed transformers because:

a. Experience has definitely proved that little or no relation exists between power factor and the ability of the transformer to withstand the prescribed dielectric tests.
b. Experience has definitely proved that the variation in power factor with temperature is substantial and erratic so that no single correction curve will fit all cases.

When a factory power-factor measurement of a transformer is required, the measurement should be made with the insulation at room temperature, preferably at or close to 20°C.

0.05 AUDIBLE SOUND LEVELS

Transformers shall be so designed that the average sound level will not exceed the values given in Tables 0-2 through 0-4 when measured at the factory in accordance with the conditions outlined in ANSI/IEEE C57.12.90-1993.

The guaranteed sound levels should continue to be per Tables 0-2 through 0-4 until such time as enough data on measured noise power levels becomes available.

Sound pressure levels are established and published in this document. Sound power may be calculated from sound pressure, using the method described in C57.12.90-1993.

Rectifier, railway, furnace, grounding, mobile and mobile unit substation transformers are not covered by the tables. The tables do not apply during the time that power switches are operating in load-tap-changing transformers and in transformers with integral power switches.

ble 0-2
AUDIBLE SOUND LEVELS F .-IMMERSED POWER TRANSFORMERS

nn 1 - Class*OA, Ow and FOW Ratings
nn 2 - Class* FA and FOA First stage Auxiliary Cooling**†
nn 3 - Straight FOA* Ratings, FA* FOA* Second-stage Auxiliary Cooling*†

erage Sound vel ††, cibels	Equivalent Two-winding Rating▲																	
	350 kV BIL and Below			450, 550, 650 kV BIL			750 and 825 kV BIL			900 and 1050 kV BIL			1175 kV BIL			1300 kV BIL and Above		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
	700	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...
	1000	.	. .	...	..	..	...	...	...	...	...	...	...	...	...	...	...	...
	..	. .	...	700	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	1500	. .	..	1000	...	...	. .	..	...	...	...	...	...	...	...	...	...	...
	2000	.	. .	...	...	.	...	...	..	...	...	...	...	...	...	...	...	...
	2500	...	...	1500	...	.	.	..	..	..	...	...	...	..	..	...	...	...
	3000	...	...	2000	...	..	. .	...	...	...	...	. .	...	..	...	...	...	...
	4000	...	...	2500	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	5000	...	...	3000	...	...	...	...	...	...	...	...	...	..	...	...	...	...
	6000	...	...	4000	.	.	3000	...	...	...	...	...	...	...	...	...	...	...
	7500	6250▲▲	..	5000	3750▲▲	..	4000	3125▲▲	..	..	...	. .	...	..	...	...	...	...
	10000	7500		6000	5000	.	5000	3750	...	. .	...	. .	...	..	...	...	...	...
	12500	9375	.	7500	6250	..	6000	5000	...	...	...	...	...	...	...	...	...	...
	15000	12500	.	10000	7500	..	7500	6250	. .	...	...	...	..	. .	...	...	...	...
	20000	16667		12500	9375		10000	7500	...	...	...	...	...	...	...	...	...	...
	25000	20000	20800	15000	12500	..	12500	9375	...	...	...	...	...	..	...	...	...	...
	30000	26667	25000	20000	16667	...	15000	12500	...	12500	...	. .	...	...	..	...	...	...
	40000	33333	33333	25000	20000	20800	20000	16667	...	15000	...	...	12500	...	...	...	...	...
	50000	40000	41667	30000	26667	25000	25000	20000	20800	20000	16667	...	15000	...	...	12500	...	...
	60000	53333	50000	40000	33333	33333	30000	26667	25000	25000	20000	20800	20000	16667	..	15000	...	...
	80000	66667	66667	50000	40000	41667	40000	33333	33333	30000	26667	25000	25000	20000	20800	20000	16667	...
	100000	80000	83333	60000	53333	50000	50000	40000	41667	40000	33333	33333	30000	26667	25000	25000	20000	20800
	...	106667	100000	80000	66667	66667	60000	53333	50000	50000	40000	41667	40000	33333	33333	30000	26667	25000
	..	133333	133333	100000	80000	83333	80000	66667	66667	60000	53333	50000	50000	40000	41667	40000	33333	33333
	...	...	166667	...	106667	100000	100000	80000	83333	80000	66667	66667	60000	53333	50000	50000	40000	41667
	...	...	200000	...	133333	133333	...	106667	100000	100000	80000	83333	80000	66667	66667	60000	53333	50000
	..	...	250000	...	...	166667	...	133333	133333	...	106667	100000	100000	80000	83333	80000	66667	66667
	..	...	300000	...	...	200000	...	...	166667	...	133333	133333	...	106667	100000	100000	80000	83333
	..	...	400000	...	...	250000	...	...	200000	...	...	166667	...	133333	133333	...	106667	100000
	...	...	...	...	...	300000	...	...	250000	...	...	200000	...	...	166667	...	133333	133333
	...	...	...	...	...	400000	...	...	300000	...	...	250000	...	...	200000	...	...	166667
	...	...	...	...	...	...	...	...	400000	...	...	300000	...	...	250000	...	...	200000
	...	...	...	...	...	...	...	...	...	...	...	400000	...	...	300000	...	...	250000
	...	...	...	...	...	..	...	...	...	...	...	...	...	...	400000	...	...	300000
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	400000

Classes of cooling (see 2.6.1 of American National Standard C57.12.00-1988.
First- and second-stage auxiliary cooling (see TR 1.0.02).
For column 2 and 3 ratings, the sound levels are with the auxiliary cooling equipment in operation.
†For intermediate kVA ratings, use the average sound level of the next larger kVA rating.
The equivalent two-winding 55°C or 65°C rating is defined as one-half the sum of the kVA rating of all windings.
▲Sixty-seven decibels for all kVA ratings equal to this or smaller.

Table 0-3
AUDIBLE SOUND LEVELS FOR LIQUID-IMMERSED DISTRIBUTION TRANSFORMERS AND NETWORK TRANSFORMERS

Equivalent Two-winding kVA	Average Sound Level, Decibels
0–50	48
51–100	51
101–300	55
301–500	56
750	57
1000	58
1500	60
2000	61
2500	62

Small Transformer

Table 0-4
AUDIBLE SOUND LEVELS FOR DRY-TYPE TRANSFORMERS 15000-VOLT NOMINAL SYSTEM VOLTAGE AND BELOW

Equivalent Two-Winding kVA	Average Sound Level, Decibels		Equivalent Two-winding kVA	Average Sound Level, Decibels Ventilated Forced Air Cooled **,†
	Self-cooled Ventilated*	Self-cooled Sealed*		
0–50	50	50	...	...
51–150	55	55	...	...
151–300	58	57	3–300	67
301–500	60	59	301–500	67
501–700	62	61	501–833	67
701–1000	64	63	834–1167	67
1001–1500	65	64	1168–1667	68
1501–2000	66	65	1668–2000	69
2001–3000	68	66	2001–3333	71
3001–4000	70	68	3334–5000	73
4001–5000	71	69	5001–6667	74
5001–6000	72	70	6668–8333	75
6001–7500	73	71	8334–10000	76

Large Transformer

* Class AA rating

**Does not apply to sealed-type transformers

†Class FA and AFA ratings

Part 1
POWER TRANSFORMERS

The American National Standard C57.12.10-1988 has been approved as a NEMA Standard for power transformers and should be inserted in this Part 1.

The ANSI/IEEE Standard C57.92-1992, has been approved by NEMA and should be inserted in this Part 1.

The following other parts of this NEMA Publication No. TR 1 shall also apply:

a. Part 1 General
b. Part 6 Terminology
c. Part 7 Test Code
d. Part 12 Underground-Type Three-Phase Distribution Transformer

Satcon™

Clean power.

Unparalleled Performance

Satcon enables you to closely match array capacities to achieve maximum energy throughput.

+20%

Edge™ MPPT

Features a proprietary maximum power point tracking (MPPT) system

Provides rapid and accurate control

Improves performance by up to 20%, even in challenging climate conditions

Boosts overall PV plant kilowatt yield

Provides a wide range of operation across all photovoltaic cell technologies, including thin film, monocrystalline, and polycrystalline PV panels

Power Efficiency

Full array nameplate power rating maintained throughout the entire MPPT DC voltage range

Superior dynamic performance in cloudy conditions

Printed Circuit Board Durability

Wide thermal operating range: -40° C (-40° F) to 85° C (185° F)

Conformal coated to withstand extreme humidity and air-pollution levels

Proven Reliability

Rugged and reliable, PowerGate Plus PV inverters are engineered from the ground up to meet the demands of large-scale installations.

Low Maintenance

Modular components make service efficient

Dual cooling fans

Safety

Seismic Zone 4 compliant

Built-in DC and AC disconnect switches

Integrated DC two-pole disconnect switch isolates the inverter (with the exception of the GFDI circuit) from the photovoltaic power system to allow inspection and maintenance

Protective cover over exposed power connections

PowerGate® Plus 1 MW Commercial Solar PV Inverter

PowerGate Plus 1 MW Specifications		UL/CSA	CE
Input Parameters			
Maximum Array Input Voltage	900V DC (CE)	•	•
Input Voltage Range (MPPT; Full Power)	420–850V DC	•	•
Maximum Input Current	2,397A DC	•	•
Output Parameters			
Nominal Output Voltage to Transformer	265V AC	•	•
Output Frequency Range	59.5–60.5 Hz	•	
	49.5–50.5 Hz		•
AC Voltage Range Set Points	-12%/+10%	•	•
Nominal Output Frequency	60 Hz	•	
	50 Hz		•
Number of Phases	3	•	•
Maximum Output Current per Phase	2,178A	•	•
Maximum Overcurrent Protection per Phase	2,614A	•	•
CEC-Weighted Efficiency	97%	•	•
Maximum Continuous Output Power	1000 kW (1000 kVA)	•	•
Power Factor at Full Load	>0.99	•	•
Harmonic Distortion	<3% THD	•	•
Temperature			
Operating Ambient Temperature Range (Full Power)	-20° C to +50° C	•	•
Storage Temperature Range	-30° C to +70° C	•	•
Cooling	Forced Air	•	•
Noise			
Noise Level	<65 dB(A)	•	•

• Standard ○ Optional

Satcon™

PowerGate Plus 1 MW

PowerGate Plus 1 MW	
UL/CSA	265V AC Output
CE	265V AC Output

External transformer required.

Streamlined Design

With all components encased in a single, space-saving enclosure, PowerGate Plus PV inverters are easy to install, operate, and maintain.

Single Cabinet with Small Footprint

Convenient access to all components

Large in-floor cable glands make access to DC and AC cables easy

Rugged Construction

Engineered for outdoor environments

Output Transformer (Optional)

Provides galvanic isolation

Uses medium voltage output to accommodate long-distance power feeds to designated loads or substations

PowerGate Plus 1 MW Specifications		UL/CSA	CE
Combiner			
Number of Inputs and Fuse Rating	40 (160A DC) (Opt.)	o	o
	60 (100A DC) (Opt.)	o	o
Transformer			
External Transformer		o	o
Inverter and Integrated External Transformer Cabinets			
Enclosure Rating (Outdoor)	NEMA 3R, IP44	•	•
Enclosure Finish (16-Gauge, Powder-Coated Steel)	RAL-7032	•	•
Base and Door Finish (14-Gauge, Powder-Coated Steel)	RAL-7032	•	•
Cabinet Dimensions (Height x Width x Depth)	Inverter	107" x 148" x 84" (272 cm x 376 cm x 213 cm)	
Cabinet Weight	Inverter	12,000 lbs.	5,443 kg
Testing and Certification			
UL1741, CSA 107.1-01, IEEE 1547, IEEE C62.41.2		•	
CE Certification			•
Zone 4 Seismic Rating		•	•
Warranty			
Five Years		•	•
Extended Warranty (10, 15, or 20 years) (Optional)		o	o
Extended Service Agreement (Optional)		o	o
Intelligent Monitoring			
Satcon PV View® Plus (Optional)		o	o
Satcon PV Zone (Optional)		o	o
Third-Party Compatibility		o	o

• Standard
o Optional

Note: Specifications are subject to change.

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